SHEET BENDING BRAKE

RELATED APPLICATIONS

[0001] This application claims priority to provisional patent applications having serial numbers 60/267,777 and 60/268,191 filed February 9, 2001 and February 12, 2001, respectively.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The subject invention relates to sheet bending brakes.

2. Description of the Related Art

[0003] Sheet bending brakes are used for bending and cutting metal or plastic sheets such as those used for siding on homes and buildings. A typical sheet bending brake functions by clamping a work piece between clamping members and using a hinged bending arm to bend the work piece about the clamping member. These sheet bending brakes allow for the clamping member to move between an open position and a clamped position.

[0004] In the use of such brakes, the work piece is often forced out of position as the clamping member is moved from the open position to the clamped position. This results from the vibrating and shaking of the bending brake while being moved into the clamped position. Repositioning of the work piece requires that the clamping members be moved back to the open position to release the work piece. After repositioning, the work piece may again be forced out of position as the clamping

members are returned to the clamped position. An operator may choose to control the sheet bending brake in an intermediate position by supporting the clamping members with one hand. However, this leaves only one hand free to reposition the work piece and does not allow for precise alignment of the work piece.

[0005] Most typical sheet bending brakes used for heavy duty applications are designed to be carried by one person when in a transport position. However, it can be cumbersome and difficult to transport due to its weight. Additionally, sheet bending brakes can be adjusted to varying lengths by adding additional clamping members which makes it more difficult to transport. Therefore, these sheet bending brakes require two people to transport because of an inability for one to lift and move the brake.

[0006] The related art sheet bending brakes, as described above, are characterized by one or more inadequacies. Specifically, the sheet bending brakes are limited to only the open position and the clamped position without allowing for precise alignment of the work piece. Additionally, the sheet bending brakes are cumbersome and do not provide for quick and easy transportation of the sheet bending brakes.

SUMMARY OF THE INVENTION AND ADVANTAGES

[0007] The subject invention provides a sheet bending brake assembly for securing a work piece. The sheet bending brake assembly includes a clamping member having a lower leg extending therefrom, a pivoting arm pivotally supported by and extending from the clamping member to define a clamping area with the lower leg, and a guide mechanism reacting between the clamping member and the pivoting arm for moving the pivoting arm between an open position and a closed position. The guide

mechanism has a detent between the open and the clamped positions for providing an intermediate clamping position for adjusting the position of and precisely aligning the work piece.

[0008] The subject invention further provides the sheet bending brake assembly including a plurality of clamping members and a base supporting the clamping members with the base being collapsible between a transport position and a support position. The base has a front rail and a rear rail defining a table such that the clamping members are supported by the front rail and the rear rail, and the table has a first table end and a second table end. A wheel mechanism is pivotably connected to one of the table ends and is pivotable between a rolling position and a working position for allowing quick and easy transportation of the assembly.

[0009] Accordingly, the subject invention overcomes the inadequacies that characterize the related art sheet bending brakes. The subject invention provides the sheet bending brake assembly with the intermediate clamping position that allows for the work piece to be precisely aligned when in the clamped position. Also, the subject invention allows for quick and easy transportation of the sheet bending brake assembly without requiring disassembly or additional assistance.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Other advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

[0011] Figure 1 is a perspective view of a sheet bending brake assembly according to the subject invention;

[0012] Figure 2 is a perspective view of a guide mechanism for operating the sheeting bending brake assembly of Figure 1 from a different angle;

[0013] Figure 3 is a side view of the guide mechanism showing a guide slot receiving a pin;

[0014] Figure 4 is yet another perspective view of the guide mechanism;

[0015] Figure 5 is a side view of a single clamping member in an open position;

[0016] Figure 6 is a side view of the single clamping member of Figure 5 in an intermediate position;

[0017] Figure 7 is a side view of the single clamping member of Figure 6 in a clamped position;

[0018] Figure 8 is a perspective view the sheet bending brake assembly of Figure 1 having a bend indicator attached;

[0019] Figure 9 is a perspective view of a sheet bending brake assembly having a wheel mechanism attached to one end for transporting the assembly;

[0020] Figure 10 is a perspective view of the sheet bending brake of Figure 9 in a rolling position;

[0021] Figure 11 is a perspective view of the wheel mechanism; and

[0022] Figure 12 is another perspective view of the wheel mechanism.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0023] Referring to the Figures, wherein like numerals indicate like or corresponding parts throughout the several views, a sheet bending brake assembly for securing a work piece **28** is generally shown at **20** in Figure 1.

[0024] The sheet bending brake assembly **20** includes a clamping member **22** having a lower leg **24** extending therefrom. The clamping member **22** is generally a C-shaped frame member and has an upper leg **26** extending therefrom. As seen in Figure 1, a plurality of longitudinally spaced clamping members **22** form the assembly **20** and allow for engaging differently sized work pieces **28**, as will be described below. However it is to be understood that any number of clamping members **22** may be utilized with the subject invention. Figures 5 through 7 illustrate a single clamping member **22** that forms the sheet bending brake assembly **20**. It should be appreciated that each of the frame members is substantially identical. Preferably, the clamping members **22** are made of lightweight aluminum to facilitate transportation of the sheet bending brake assembly **20**. However, different materials may be utilized for providing additional support to the assembly **20** as is known in the art of sheet bending brakes.

[0025] A pivoting arm **30** is pivotally supported by and extends from the clamping member **22**. The pivoting arm **30** defines a clamping area **32** with the lower leg **24**. The clamping area **32** has a throat depth **25** and forms a working pocket **27**. Designing the C-shaped frame member differently can alter both the throat depth **25** and working pocket **27**. The pivoting arm **30** has a secured end **34** and a free end **36**, such that a bolt **38** extends through the secured end **34** and into the clamping member **22**. The pivoting arm **30** is moveable between an open position and a clamped position by pivoting about the bolt **38** while moving between the open position and the clamped position.

[0026] An upper clamping surface **40** is connected to the free end **36** of the pivoting arm **30** and a lower clamping surface **42** is connected to the lower leg **24**. The upper

clamping surface **40** and the lower clamping surface **42** engage one another in the clamped position to secure the work piece **28** therebetween. The opening between the upper clamping surface **40** and the lower clamping surface **42** is commonly referred to as a mouth opening. After the work piece **28** is secured, the upper and lower clamping surfaces **40**, **42** create a bending surface **44** that the work piece **28** is bent about. Additionally, the sheet bending brake assembly **20** may be used with a tool cutter (not shown) for cutting the work piece **28** while in the clamped position. It is to be understood that many different tools known in the art of sheet bending brakes may be utilized with the subject invention.

[0027] As shown in Figure 1, a base **46** supports the clamping members **22** and provides support to the assembly **20** while moving the pivoting arm **30** between the open position and the clamped position. The base **46** includes a front rail **48** and a rear rail **50** defining a table **52** such that the clamping members **22** are supported by the front rail **48** and the rear rail **50**. The table **52** has a first table end **54** and a second table end **56**.

[0028] The assembly **20** further includes a guide mechanism **58** reacting between the clamping member **22** and the pivoting arm **30** for moving the pivoting arm **30** between the open position and the clamped position. The guide mechanism **58** has a detent **60** between the open and the clamped positions for providing an intermediate clamping position for adjusting the position of and precisely aligning the work piece **28**. When the sheet bending brake assembly **20** is in the intermediate clamping position, the upper clamping surface **40** is in close proximity to, but not in contact with, the lower clamping surface **42** of the lower leg **24**. In order to secure the sheet

bending brake assembly **20** in the intermediate position, a stop **62** is positioned adjacent the detent **60** for sustaining the intermediate position.

[0029] The guide mechanism **58** has an aperture **64** for receiving a handle **66**. The handle **66** extends from the guide mechanism **58** for facilitating movement of the pivoting arm **30** between the open and the clamped positions. The handle **66** functions to move the pivoting arm **30**, thereby rotating the guide mechanism **58**. The handle **66** may be a single lever for a single clamping member **22**, as shown in Figures 5 through 8, or a long bar engaging the plurality of clamping members **22** as shown in Figure 1.

[0030] The guide mechanism **58** also includes a guide slot **68** having a first end **70** and a second end **72** such that the first end **70** corresponds to the open position and the second end **72** corresponds to the clamped position. The detent **60**, as shown in Figures 2 through 4, is positioned within the guide slot **68** between the first and the second ends **70**, **72**. In one embodiment, the guide slot **68** is arcuate and includes a long portion **74** and a short portion **76**, the long portion **74** being substantially horizontal and the short portion **76** being substantially vertical. The guide slot **68** may be designed differently to accommodate differently sized clamping members **22** without deviating from the subject invention. The guide mechanism **58** may be further defined as a pivot bracket. The pivot bracket has an upper region and a lower region such that the guide slot **68** is disposed between the upper region and the lower region.

[0031] In yet another embodiment, referring to Figure 3, the guide mechanism **58** includes a plurality of detents **60** positioned between the first and the second ends **70**, **72**. The plurality of detents **60** provides for a plurality of intermediate clamping

positions for receiving work pieces **28** of varying thickness. Corresponding to each of the detents **60** is a plurality of stops **62** within the guide slot **68** and adjacent the plurality of detents **60** to secure the sheet bending brake assembly **20** in each of the intermediate positions.

[0032] The sheet bending brake assembly **20** has a pin **78** supported by the clamping member **22** and disposed in the guide slot **68** such that the guide mechanism **58** rotates about the pin **78** between the first end **70** and the second end **72**. In operation, the handle **66** rotates the guide mechanism **58** about the pin **78**, which causes the pivoting arm **30** to move between the open position and the clamped position. Referring to Figure 5, the single clamping member **22** is shown with the pivoting arm **30** in the open position and with the pin **78** at the first end **70** of the guide slot **68**. In Figure 6, the handle **66** is operated and the pivoting arm **30** is now in the intermediate position and the pin **78** is in the detent **60** of the guide slot **68**. The movement into the intermediate position reduces the opening between the upper clamping surface **40** and the lower clamping surface **42** to a predetermined distance. The predetermined distance is determined by the location of the detent **60** within the guide slot **68**. As shown, the predetermined distance at the intermediate position is about one inch. Finally, Figure 7 shows the pivoting arm **30** in the clamped position and in contact with the lower clamping surface **42**. In the clamped position, the pin **78** is now in the second end **72** of the guide slot **68**.

[0033] Referring to Figures 8 and 9, a bending arm **80** is supported by the clamping member for engaging the work piece **28** and bending the work piece **28** to a desired angle. The bending arm **80** extends the length of the sheet bending brake assembly **20** and contacts the work piece **28** when rotated. The bending arm **80** is preferably

hingedly connected with the lower clamping surface **42**. The bending arm **80** also has extensions **81** extending from the bending arm **80** for allowing easy rotation of the bending arm **80**.

[0034] The assembly **20** further includes a bend indicator **82** connected to the bending arm **80** for indicating a degree of rotation of the bending arm **80** during the bending of the work piece **28**. The bend indicator **82** includes a displacement sensor **84** for measuring the degree of rotation of the bending arm **80** and a display device **86** for displaying the degree of rotation of the bending arm **80**. The bend indicator **82** may be any type of electrical or mechanical device capable of measuring a degree of rotation. In one embodiment, the displacement sensor **84** is a housing **88** supported by the lower leg **24** and a cable **90** extending from the housing **88** and attaching to the bending arm **80**. The cable **90** extends through the lower clamping surface **42** and is fixedly connected to the bending arm **80** such that as the bending arm **80** is moved, the cable **90** is pulled through the lower clamping surface **42**. However, it is to be understood that the cable **90** may also extend through the front rail **48** of the base **46**. The housing **88** is preferably detached from the table **52**, except for the cable **90**, to allow for easy viewing of the display device **86** in different positions.

[0035] The display device **86** is further defined as a viewing window **92** within the housing **88** and a disc **94** housed within the housing **88** and connected to the cable **90** for moving within the housing **88** to indicate the degree of rotation through the viewing window **92**. Indicia **96** may be positioned adjacent the viewing window **92** corresponding to the degree of rotation of the bending arm **80**. Further, the bend indicator **82** may include a calibration device **98**. The calibration device **98** may be connected to the cable **90** and the bend indicator **82** for calibrating the bend indicator

82. As the assembly **20** is utilized, the cable **90** will stretch and therefore calibrating the bend indicator **82** is required. The calibration device **98** tightens the cable **90** to a desired tautness when the bending arm **80** is a non-bending position. After the cable **90** is tightened, the bend indicator **82** is calibrated for successive uses.

[0036] Referring to Figures 9 through 12, a wheel mechanism **100** is pivotably connected to one of the table ends **54**, **56** and being pivotable **52** between a rolling position and a working position. The wheel mechanism **100** is shown connected to the first table end **54**, however, it is to be appreciated that the wheel mechanism **100** may be attached to either the first table end **54** or the second table end **56** or both. The subject invention includes a pivot **102** engaging the wheel mechanism **100** and the table **52** for allowing the wheel mechanism **100** to rotate between the rolling position and the working position. A locking device **104** between the wheel mechanism **100** and the table **52** locks the wheel mechanism **100** in the rolling position and unlocks the wheel mechanism **100** to allow the wheel mechanism **100** to rotate into the working position. The sheet bending brake in Figure 9 shows the wheel mechanism **100** in the working position. Figures 10 through 12 show the wheel mechanism **100** in the rolling position.

[0037] The wheel mechanism **100** further includes a wheel brace **106** extending between the front rail **48** and the rear rail **50** and engaging the locking device **104**. In one embodiment, the wheel brace **106** is an upwardly facing U-shaped bar. Additionally, the wheel brace **106** has a plate **108** attached to the U-shaped bar. The plate **108** has holes that are aligned with holes in the rails for receiving the locking device **104** and the pivot **102**. The locking device **104** and the pivot **102** both engage the plate **108** and the rails **48**, **50** to secure the wheel mechanism **100** and to allow the

wheel mechanism **100** to pivot. It is to be understood that the wheel brace **106** may be any other shape of material while still accomplishing the subject invention. The wheel brace **106** also has a notch **110** aligned with the front rail **48** and the rear rail **50**. The notch **110** receives the front rail **48** and the rear rail **50** in the rolling position. The notch **110** has an indentation **112** that allows the wheel mechanism **100** to pivot **102** without contacting either of the front or rear rails **48**, **50**. The indentation **112** receives the front rail **48** and the rear rail **50** when in the working position.

[0038] The wheel mechanism **100** also includes a pair of wheels **114** having a wheel support **116** extending therebetween and being connected to the wheel brace **106**. The wheels are used for transporting the assembly **20**. The pair of wheels **114** may be replaced with any other device, such as a roller, as is known in the art. A wheel extension **118** interconnects the wheel support **116** and the wheel brace **106** such that as the wheel extension **118** pivots, the wheel mechanism **100** extends a predetermined amount below the table **52** to allow for insertion of the work piece **28** within the clamping area **32**, as shown in Figure 9. In one embodiment, the front and rear rails **48**, **50** do not extend beyond the wheel mechanism **100** any further than the radius of each wheel to prevent the front and rear rails **48**, **50** from contacting the ground during transport. After the base **46** has been collapsed into the transport position, the wheel mechanism **100** presently described can be used by one person to transport the sheet bending brake assembly **20**.

[0039] To secure the sheet bending brake to the table **52**, the wheel mechanism **100** is pivoted such that the rails are seated in the notch **110**. Then, the locking device **104** is inserted through the hole in the plate **108** in the front and rear rails **48**, **50**. As illustrated, the locking device **104** is a locking pin having a ring for easy removal.

The locking pin is the pin closest to the pair of wheels **114**. After transport, the sheet bending brake may be lifted to rest upon the base **46** for use as shown in Figure 9. Removal of the locking pin from the front rail **48** and the rear rail **50** allows the wheel assembly **20** to rotate about the pivot **102**. The pivot **102** is preferably a pivot pin having a ring and extending through the plate **108** and the front rail **48** and rear rail **50**. However, it is to be understood that the pivot **102** may also be a rod extending the width of the table **52** and engaging the plate **108** on the opposite side. In the preferred embodiment, the pivot pin is farthest away from the pair of wheels **114**. As described above, the indentation **112** in the notch **110** is aligned with the center of the pivot pin. The indention is aligned with the center of the pivot **102** to allow the front and rear rails **48**, **50** to be received by the notch **110** when the locking pin is removed. It is to be understood that the indention may be aligned differently by modifying other features of the wheel mechanism **100**.

[0040] Obviously, many modifications and variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims, wherein reference numerals are merely for convenience and are not to be in any way limiting, the invention may be practiced otherwise than as specifically described.